

Cleaning Technologies

- Changes in Aerospace Cleaning Methods -

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Cleaning Methods at MDA-STL Prior to 1992

- Vapor Degreasing
 - Metal Parts with Trichloroethylene (TCE)
 - Electrical Parts with 1,1,1 -Trichloroethane (TCA)
- Handwipe Solvent Cleaning
 - TCA - Non-Flammable, General Parts Cleaning
 - MEK (Methyl Ethyl Ketone) - Flammable, Good for Cleaning Difficult to Clean Parts



Environmental Regulations Affecting Cleaning Solvents

- TCE - HAP (Hazardous Air Pollutant) and VOC
 - EPA Clean Air Act NESHAP Requires Control of Halogenated Cleaning Solvents by Dec. 1997
- TCA - ODS (Ozone Depleting Substance)
 - Production of TCA Discontinued After 1995
- MEK - HAP and VOC with VP > 45 mm Hg
 - EPA Clean Air Act NESHAP Prohibits Use of HAP or VOC Solvents with VP > 45 mm Hg by Sept. 1998

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Replacement Cleaning Technologies

- Replacements Identified for:
 - TCE Metal Parts Vapor Degreasers
 - TCA Electrical Parts Vapor Degreasers
 - TCA Handwipe Solvents
- Replacements in Test for:
 - MEK Handwipe Solvents
- R&D Efforts for New Cleaning Technologies
 - CO₂/UV Cleaning Method
 - Tube Cleaning Equipment

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TCE Vapor Degreaser Replacements

- Identify Uses

- Metal Part Cleaning (Alloy, Size, Complexity)
 - Tubing, Honeycomb, and Active Metals (e.g. Cadmium, Magnesium) are Difficult to Clean

- Identify Soils

- Many Lubricants Used at MDA-STL but #140 Stick Wax is the Most Difficult to Remove

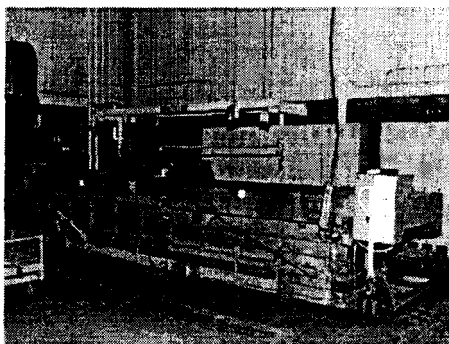
- Identify Requirements

- Must Remove Bulk of Lubricants From Parts and Not Cause Any Corrosion on Parts per P.S. 12024
 - Water Break Free Surface Not Required

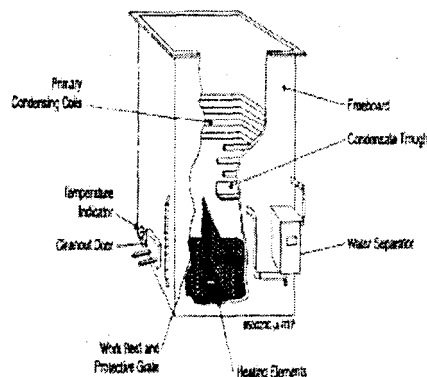
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TCE Vapor Degreaser Replacements



30 Foot Long TCE Vapor Degreaser



Major Features of a Vapor Degreaser

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TCE Vapor Degreaser Replacements

- . Identify Alternate Cleaning Materials
 - Semi-Aqueous or Solvent
 - Contains Solvents (VOC)
 - Solvents May Be HAP, Flammable, Toxic
 - Aqueous
 - Contains Alkaline Cleaners/Detergents/Soaps
 - Exotic (Super Critical CO₂, Laser, Plasma, etc.)
- . Identify Alternate Cleaning Methods
 - Immersion with Agitation or Spray (or Both)
 - Ultrasonics

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TCE Vapor Degreaser Replacements

- . Aqueous Degreasing Preferred
 - Pros
 - No VOCs, No HAPs
 - Cleans Better Than Vapor Degreasing Because It Removes Both Oil and Dirt
 - Low Operating Cost and No Odor
 - Cons
 - Impacts Waste Water Treatment Facility
 - Corrosion of Metal Parts
 - Complex Parts are Difficult to Clean
 - Cleaning Cycle Time is Increased

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TCE Vapor Degreaser Replacements

- . Numerous Aqueous Cleaners Screened by Aerospace Industry
 - Data Sharing Between Aerospace Industry
 - Reduced Test Time and Costs
- . MDA-STL Selected Three Cleaners to Use
 - Brulin 8 15GD - Excellent Cleaning Formula
 - DaraClean 23 8 - Good Corrosion Inhibitor Package
 - Turco 42 15 NCLT - Good for Lightly Soiled Parts

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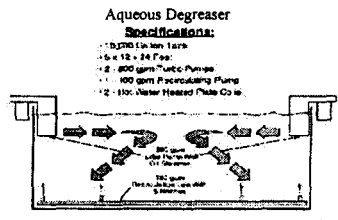
TCE Vapor Degreaser Replacements

- . Cleaning Method Selected
 - Large Immersion Tanks with Mechanical Agitation
 - . Bowden Turbo Pumps Provide Agitation but Eductors Work Just as Well
 - Heating is Critical to Effective Cleaning
 - . 10°F Rise in Temp. Can Cut Cleaning Time in Half
 - Need to Avoid Potential for Galvanic Corrosion Between Parts and Cleaning Equipment
 - . Plastic Insulators/Stainless Steel Construction

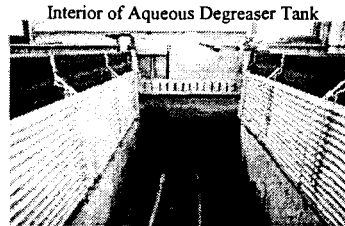
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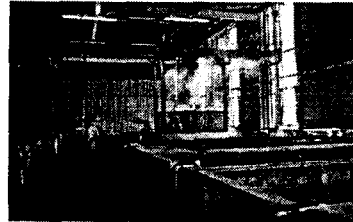
TCE Vapor Degreaser Replacements



Parts Being Cleaned in Aqueous Degreaser



Parts Being Removed from Aqueous Degreaser



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TCE Vapor Degreaser Replacements

- Three Large Aqueous Degreasers Installed at MDA-STL (10,000, 4,500, and 3,500 gal. Tanks Used)
- TCE Solvent Consumption Reduced by 75%
 - 1991 = 330,000 lbs/yr, 1996 = 85,000 lbs/yr
- Vapor Degreasers Still in Use to Clean Difficult Parts, but Work Continues to Switch to Aqueous Degreasing for
 - Tubing, Aluminum Honeycomb, Entrapment Areas, Cadmium Plated Parts, Adhesive Bonding

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